

# ТУПАЯ ТРАВМА ГРУДИ

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## BLUNT CHEST TRAUMA: CASE BASED

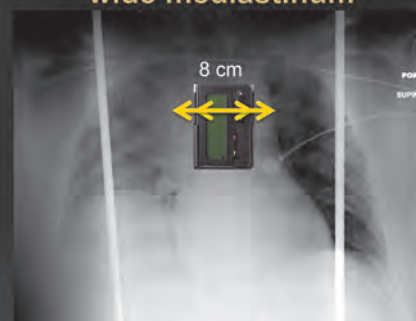
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### Learning Objectives

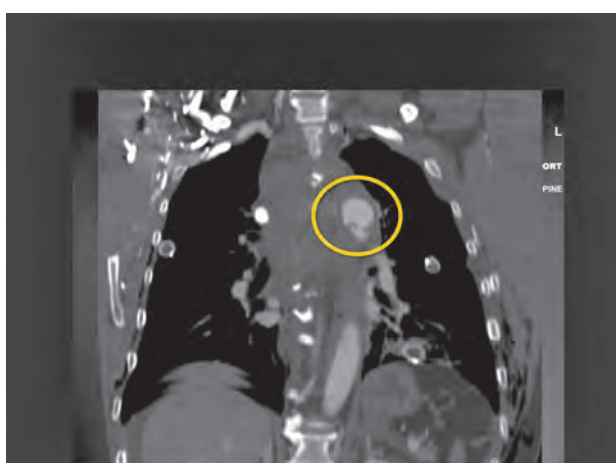
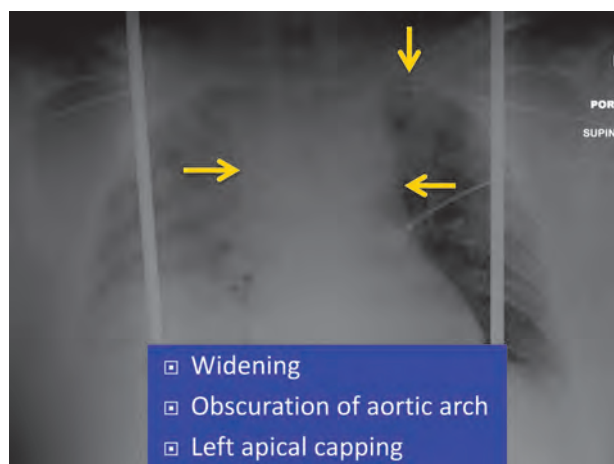
- ▣ Affirm your understanding of the essentials of:
  - Imaging essentials of selected thoracic blunt trauma injuries

### Case 1: 55 yo man high speed motor vehicle crash (HSMVC) wide mediastinum



### CXR: “wide mediastinum”

- ▣ Marker of substantial kinetic energy absorption
- ▣ Indirect/insensitive/non-specific indicator of possible aortic injury
- ▣ Identify mediastinal hemorrhage/hematoma
- ▣ Not aortic injury/bleeding
- ▣ Tears of mediastinal veins as indirect indicator of possible aortic injury



### CXR: “wide mediastinum”

- ▣ When CXR is normal: 98% NPV
- ▣ “Wide mediastinum”:
  - 53% sens, 59% spec for aortic inj
  - substantial inter-reader variability
- ▣ Other insensitive “classic” signs:
  - Obscuration of aortic outline
  - depression of the left main-stem bronchus
  - deviation of the naso-gastric tube to the right
  - apical pleural hematoma (cap)

### History very compelling also!

- 20 yo high speed motor vehicle crash
  - CXR should normally be normal
- 85 yo tripped over a curb and fell to ground from standing
  - CXR should normally be "abnormal"

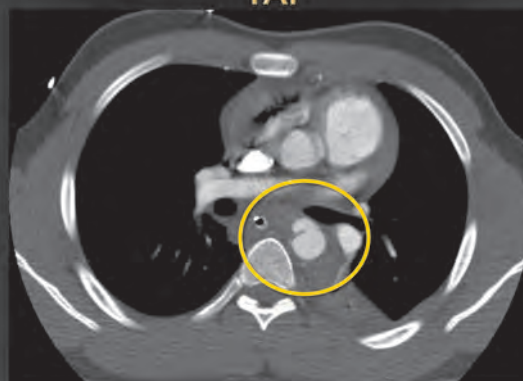
### DDX wide mediastinum

- ▣ True mediastinal hematoma
  - Traumatic aortic injury
  - Thoracic spine fx
  - Sternal fx
- ▣ Other factors
  - Fat
  - Technique: supine, fluid resuscitation, exhaling, etc

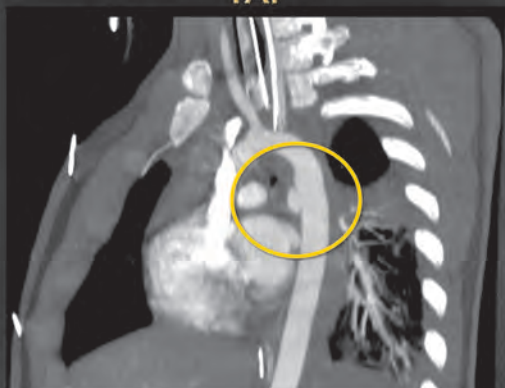
### CT Findings of Thoracic Aortic Injury (TAI)

- ▣ Most at proximal descending aorta
- ▣ Direct visualization of pseudoaneurysm
- ▣ Bulges anteriorly or antero-medially at level of left PA
- ▣ Associated mediastinal hemorrhage
- ▣ Trachea/esophagus displaced right
- ▣ Intimal flap/injury
- ▣ *Other compelling injuries*

### TAI



### TAI



### Other Causes of Mediastinal Hematoma

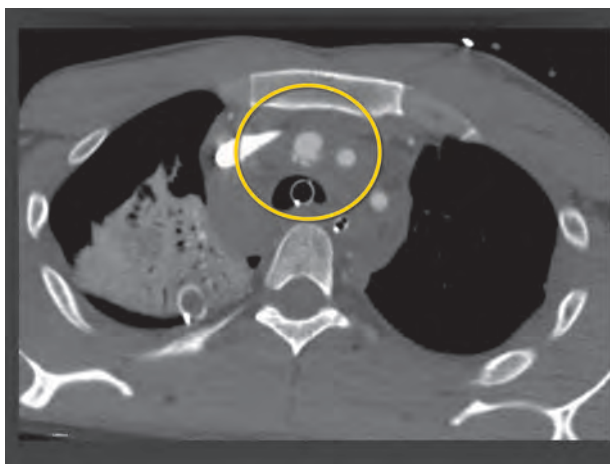
- ▣ Injury to the spine and surrounding structures
- ▣ Confidence in radiographic signs of aortic injury is significantly decreased in presence of vertebral trauma
- ▣ MDCT invaluable

### Case

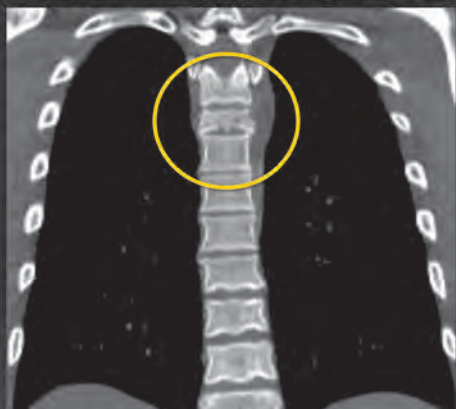




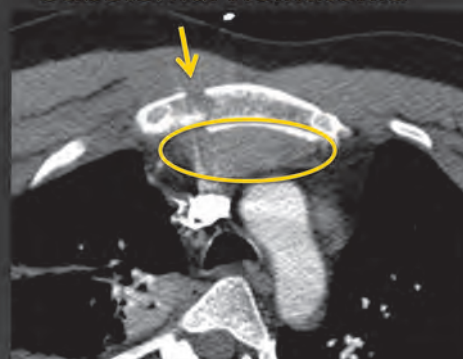
- ▣ Wide mediastinum?
- ▣ Right upper lobe collapse?
- ▣ Other?
- ▣ Both?



### Thoracic Spine Fracture



### Substernal Hematoma

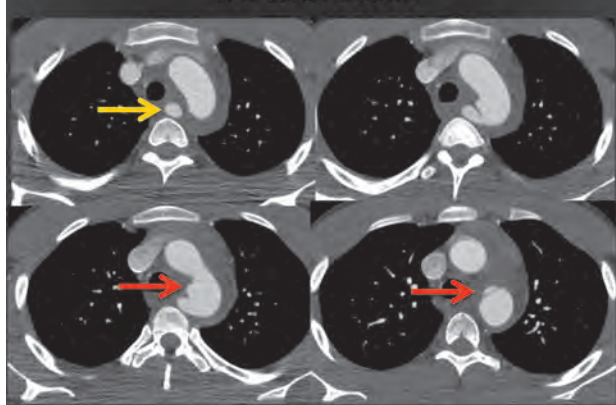


### Hickam's Dictum

- ▣ Patients can have as many diseases (injuries) as they please!



### TAI with ARSA



### Pneumothorax

- ▣ Leakage of gas from lung or airway into pleural space
- ▣ Usually associated with rib fracture
- ▣ Generally a result of direct puncture of visceral pleura



## Pneumothorax

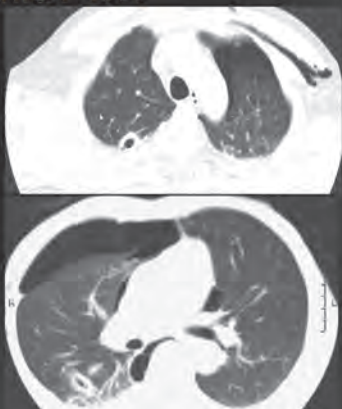
- ▣ Up to 40% of blunt chest injuries
- ▣ *Supine position* makes detection difficult
- ▣ *Direct signs*
  - Pleural line: lucent pleural separation
- ▣ *Indirect signs*
  - Deep sulcus
  - +/- associated rib fx

## Supine Imaging of PTX

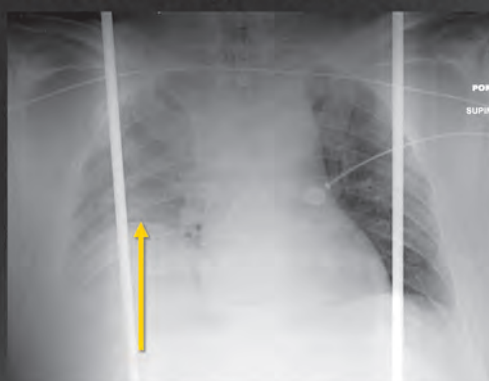
- ▣ Deep sulcus sign (prominence of the costophrenic sulcus)
- ▣ Basilar hyperlucency
- ▣ Unusually sharp delineation of mediastinal or cardiac contour

## How large is this PTX?

- ▣ Small?
- ▣ Medium?
- ▣ Large?
- ▣ 5%?
- ▣ 10%?
- ▣ 20%?
- ▣ >20%?
- ▣ 5 mm?
- ▣ 10 mm?
- ▣ 20 mm?
- ▣ >20 mm?



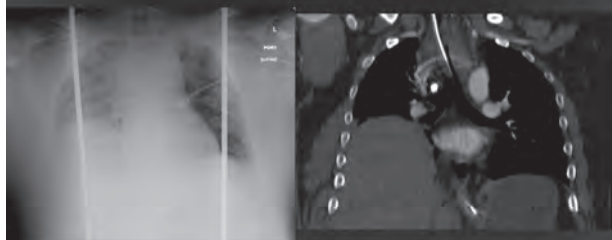
## Case #: 55 yo man HSMVC



Which of the following is *likeliest* cause of hemidiaphragm “elevation” in this case?

- A. **Rupture hemidiaphragm**
- B. Eventration
- C. Phrenic nerve injury/paralysis
- D. Subpulmonic fluid
- E. Normal variation

## 55 yo man HSMVC



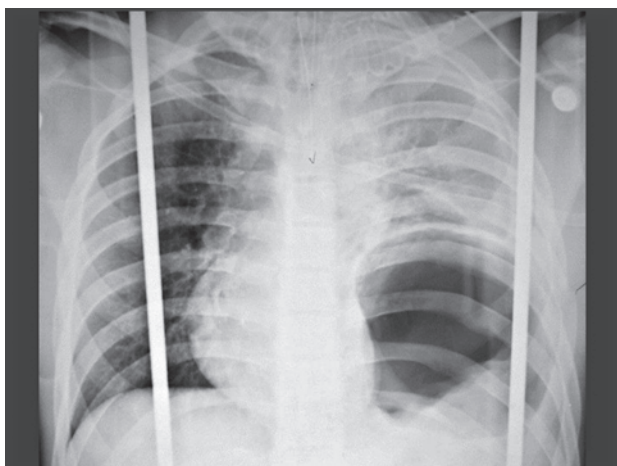
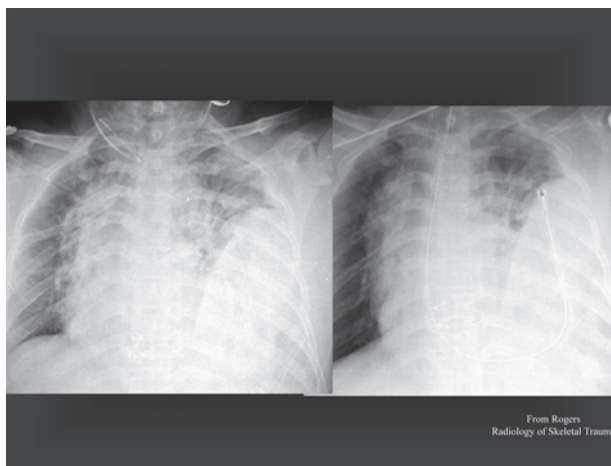
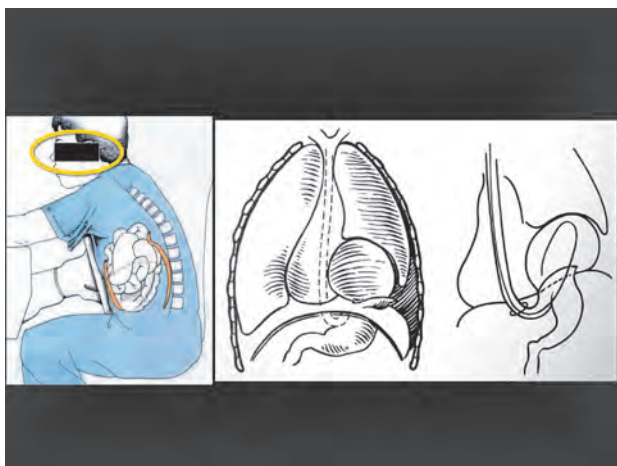
## Diaphragm Rupture

- ▣ Up to 8% of severe blunt trauma
- ▣ Rarely isolated injury
- ▣ Prevalence R v. L?
- ▣ Dx can be delayed for several reasons
- ▣ Associated HTX, hemoperitoneum, ATX, other compelling abdominal injuries
- ▣ Sine qua non: GI viscera within thorax

## Dx: Diaphragm Rupture

- ▣ Apparently elevated but distorted hemidiaphragm
- ▣ Dx aided by passage of a nasogastric tube or barium
- ▣ MDCT scan (and clinical suspicion) most helpful





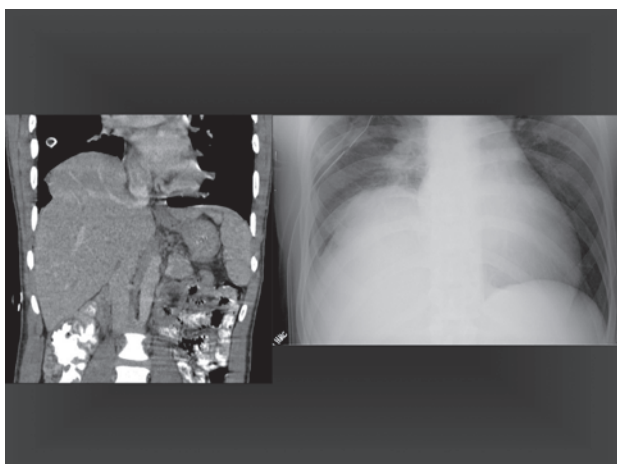
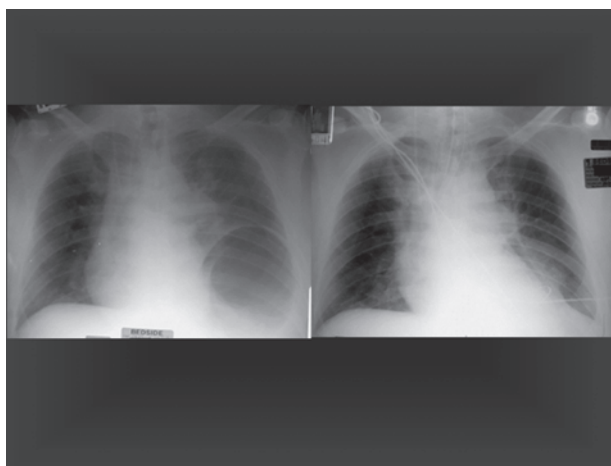
### Why does the GI viscera herniate into the thorax?

- A. Force of the injury
- B. Negative pressure in the abdomen
- C. Pressure gradient from abdomen to chest
- D. Mass effect
- E. Bleeding

### Confounding Variable

- ▣ Intubation and positive pressure ventilation
- ▣ Can *prevent* herniation of abdominal organs until weaning is achieved
- ▣ So-Called "Delayed Rupture"

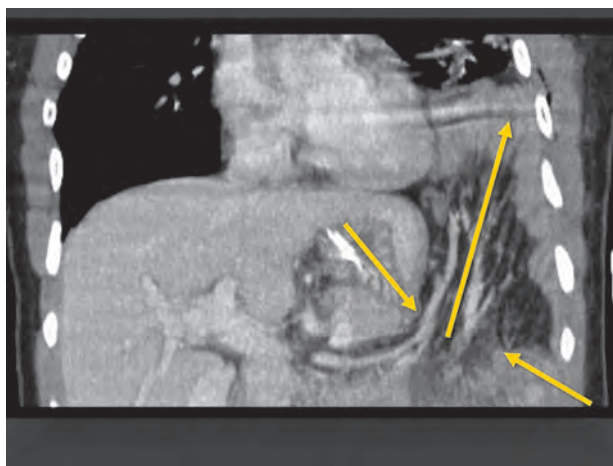
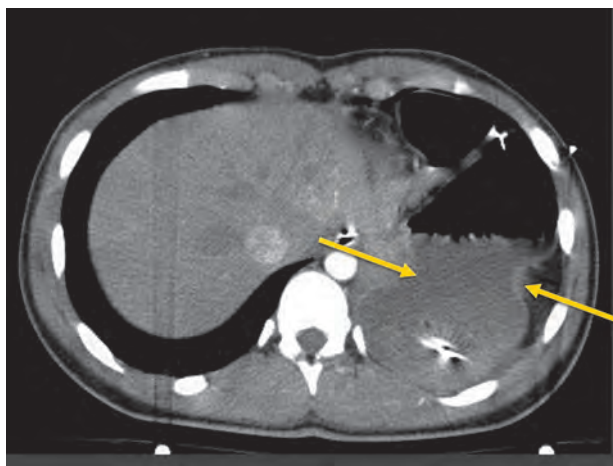
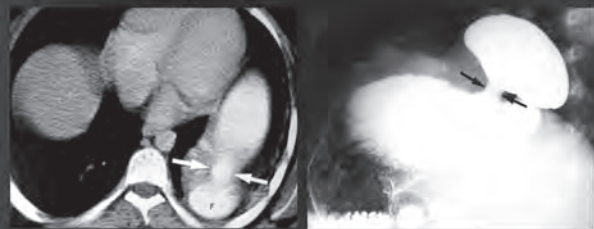
Am Surg 2002 Feb;68(2):167-72  
The impact of positive pressure ventilation on  
the diagnosis of traumatic diaphragmatic injury.  
Kenny-Jones R, Carter Y, Stern EJ



### MDCT Findings of Diaphragmatic Rupture

- ▣ Diaphragmatic defect (about 75% of cases)
- ▣ Herniation of omental fat is common
- ▣ Visceral herniation
  - stomach and left colon most frequent (about 60%)
  - Any abdominal organ may herniate

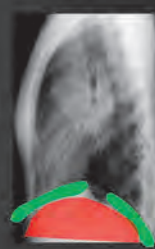
## Collar Sign



## Dependent Viscera Sign

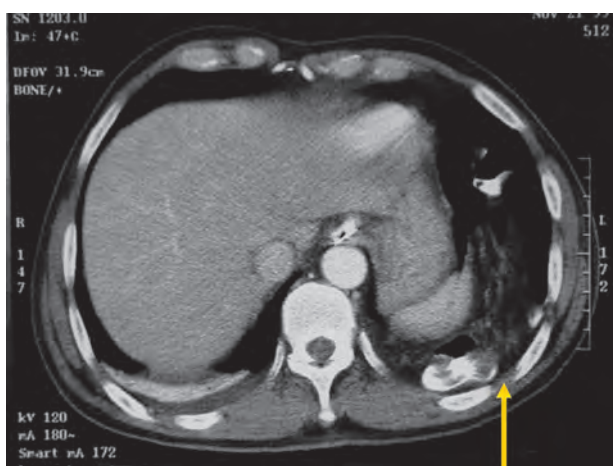
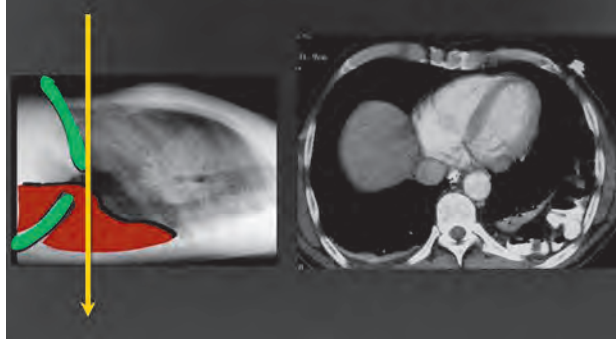
- Upper 1/3 liver abuts right post. ribs
  - 80% sensitive
- Bowel/stomach abut left post. ribs
  - >95 sensitive

## Dependent Viscera Sign



- Diaphragm
- Abdominal contents

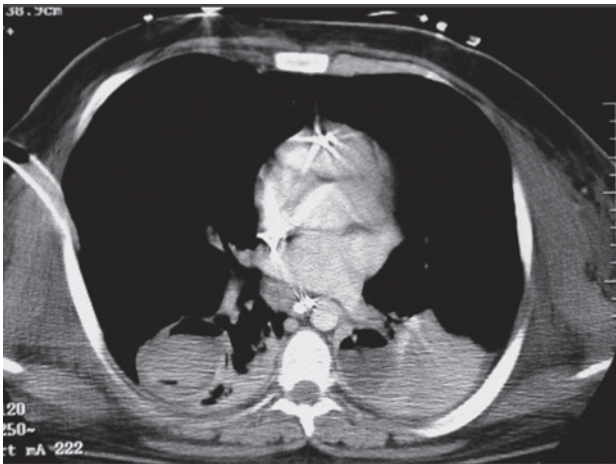
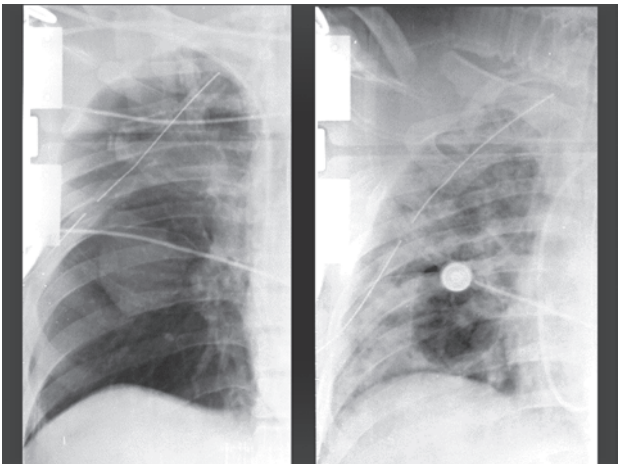
## Dependent Viscera Sign





# Pulmonary Laceration

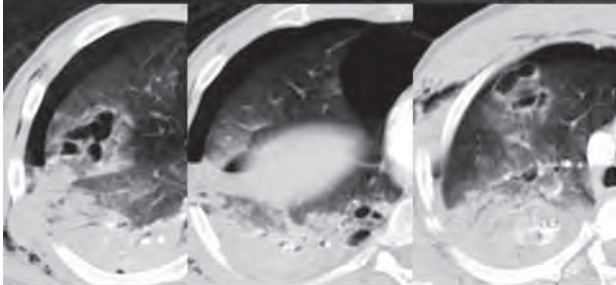
- ▣ Tear of parenchyma
- ▣ Recoil properties cause initial tear to rapidly become ovoid or round
- ▣ Filled with blood--hematoma
- ▣ Filled with air--pneumatocele
- ▣ Frequently both--prefer more general term laceration



## 30 yo man HSMVC

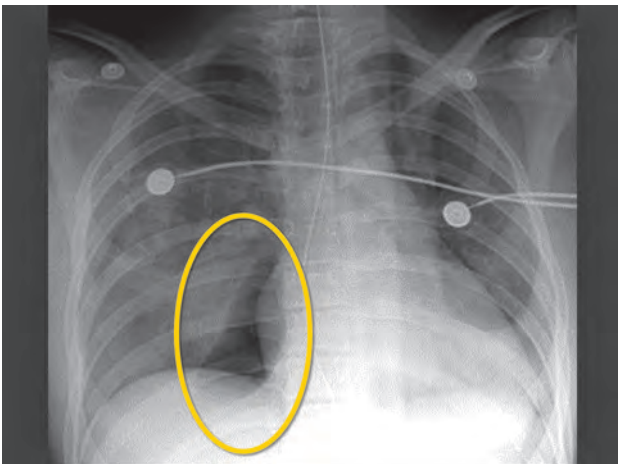
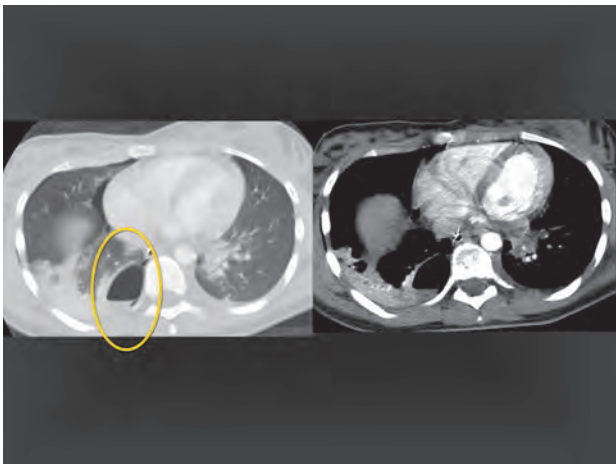
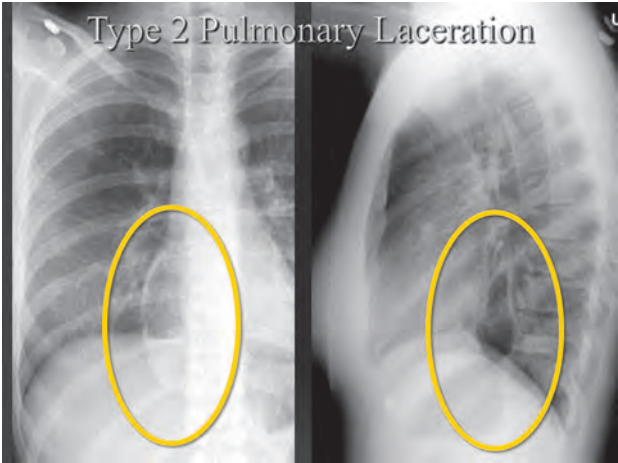


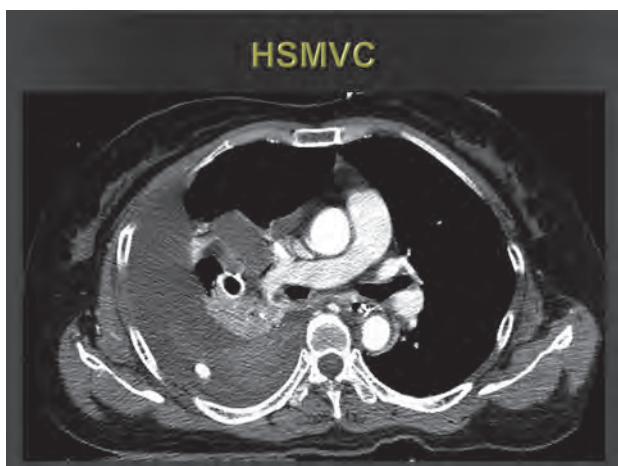
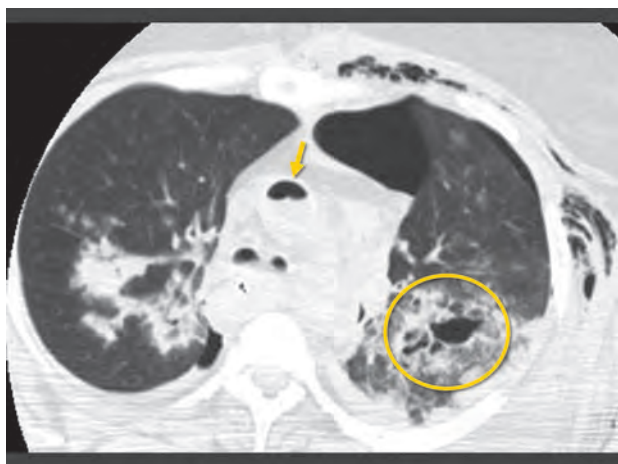
## 3 Important Mechanisms Laceration



Type 1 Compression Rupture      Type 2 Shear      Type 3 Puncture

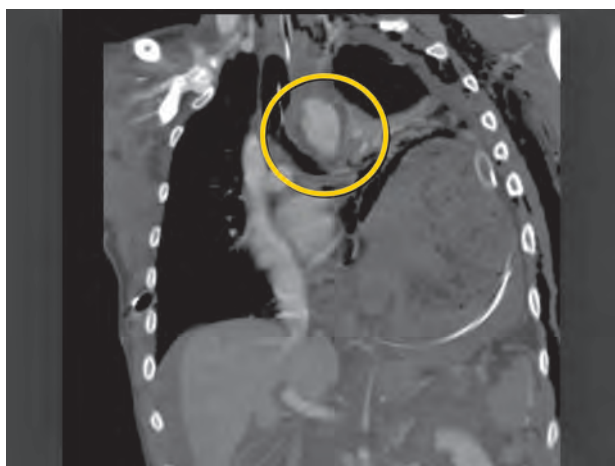
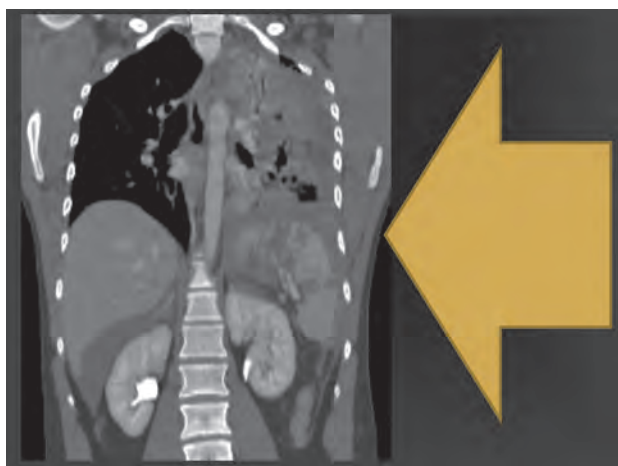
## Type 2 Pulmonary Laceration





### Kinetic Energy Absorption

- ▣ Does not respect anatomic boundaries
- ▣ Does not always allow tidy categorization
- ▣ Does not attend this lecture



### Conclusions: Increased your understanding of selected chest injuries

- ▣ DDx "Wide mediastinum"
- ▣ Imaging limitations: eg. pneumothorax
- ▣ "Elevated" hemidiaphragm
- ▣ Types/mechanisms pulmonary lacerations
- ▣ Combined injury patterns and associated changes over time